PE Civil Exam 40-Mix Questions & Answers (pdf Format)
For Breath Exam (Morning Session) Set #1
Breadth Exam (morning session): This practice exam contains 40 mix questions and answers of all five areas of civil engineering:

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I. Construction

8. PROBLEM (Temporary Structure)

As shown in the Figure a braced cut of the foundation excavation is 10 ft deep in clay with a unit weight of 122 lbs/ft³. When the wall is temporarily supported, what will be the total earth force per foot the wall?

![Diagram of wall and forces]

a. 2700.00 #/ft
b. 2400.00 #/ft
c. 2900.00 #/ft
d. 2500.00 #/ft

8. Solution:

Total force, F = \( \frac{1}{2} \times 2.5 \times 360 + 5 \times 360 + \frac{1}{2} \times 2.5 \times 360 = 2700.00 \) #/ft

Correct Solution is (a)
II. Geotechnical

15. PROBLEM (Retaining Wall)

A retaining wall shown in the Figure is at rest. What will be the lateral force per unit length of the wall?

15. Solution:

\( \Phi = 28^\circ \)
\( \gamma = 16.0 \text{ kN} / \text{m}^3 \)
\( H = 4 \text{ m} \)
\( \sigma'_h = K_0 \sigma'_v = K_0 (q_0 + \gamma H), \quad q_0 = \text{surcharge load} = 10.0 \text{ kN} / \text{m}^2 \)

Where, \( \sigma'_h = \text{Effective horizontal pressure} \)
\( \sigma'_v = \text{Effective vertical pressure} \)
\( K_0 = 1 - \sin \Phi = 0.53 \)
\( \sigma'_h = 0.53 \times (10 + 16 \times 4) = 39.22 \text{ kN} / \text{m}^2 \)

AT REST LATERAL EARTH PRESSURE

Total Lateral Force, \( P_h = \frac{H}{2} \sigma'_h = 0.5 \times 4 \times 39.22 = 78.44 \text{ kN} / \text{m} \)

Correct Solution is (c)
III STRUCTURAL

18. PROBLEM (Loading)

A concrete slab is 5” thick as shown in the Figure. The slab’s live load is 60 psf and the beam weight is 50 lb/ft. Determine the reaction of column RA where, the Concrete unit weight is 150 lb/ft$^3$.

Solution:

Beam weight=50lb/ft
Slab dead load =150 x 5/12 =62.5 lb/ft$^2$
Live Load = 60.0 lb/ft$^2$

\[
\text{Total Load} \quad W = 122.5 \text{ lb/ft}^2
\]

For 10 ft wide slab
\[
W_1 = 122.5 \times 10 + 50 = 1275.00 \text{ lb/ft}
\]

For 5 ft wide slab
\[
W_2 = 122.5 \times 5 + 50 = 662.50 \text{ lb/ft}
\]

\[
\sum M = 0
\]

Reaction at RA, RA x 18 = 662.5 x 10 x (5 +8)+1275 x 8 x 4 = 126925.00 lbs
\[
RA = 126925.00/18 = 7051.39 = 7.05 \text{ Kip}
\]

Correct Solution is (b)
IV. TRANSPORTATION

26. PROBLEM (Sight Distance)

A two lane highway has a center line shown in the Figure, passing near a building located on the inside, near the middle of the curve. The building would be 22 feet from center of the highway. Determine the sight distance for the driver in an inside lane, where each lane is 12 ft wide.

a. 240 ft
b. 200 ft
c. 250 ft
d. 320 ft

26. Solution:

BC=450-22=428 ft
AC=450-6=444 ft (For the driver in inside lane)

\[ \cos \frac{\Delta}{2} = \frac{BC}{AC} = \frac{428}{444} \]
\[ \Delta = 2 \times 15.43 = 30.86 \]
\[ D = 2 \times AC = 2 \times 444 = 888 \]
\[ \text{Arc} = \frac{\Delta \pi D}{360} \]
\[ \text{Arc} = \frac{30.86 \pi \times 888}{360} = 239.0 \text{ft}, \text{Sight Distance, S} = 239.0 \text{ ft} \]

Correct Solution is (a)
V. WATER RESOURCES AND ENVIRONMENT

40. PROBLEM (Wastewater Collection)

A wastewater treatment plant has an average flow of 12 M-gal/day and a peak to average flow ratio of 2.5. Determine the total volume of an aerated grit chamber if detention time is 3 min.

- a. 8316 ft³
- b. 4500 ft³
- c. 6127 ft³
- d. 5512 ft³

40. Solution:

\[ Q_{av} = 12 \text{ mgd}, \text{ Detention time, } t_d = 3 \text{ min.} \]

Peak flow/ \[ Q_{av} = 2.5 \]

Peak flow, \[ Q = 12 \times 2.5 = 30 \text{ mgd} = 30 \times 1.54 \text{ ft}^3/\text{sec} \]

1 mgd = 1.54 ft³/sec

Volume of aerated grit chamber, \[ V = Q \times t_d = 30 \times 1.54 \times 3 \times 60 = 8316.00 \text{ ft}^3 \]

Correct Solution is (a)